

## CLAIMS

What is claimed is:

- 1        1. A method for designing a system on a target device utilizing field programmable gate  
2        arrays (FPGAs), comprising:
  - 3            synthesizing a design for the system;
  - 4            mapping components in the design onto resources on the target device;
  - 5            determining placement locations for the components on the target device; and
  - 6            identifying components to replicate in response to criticality determined from the  
7        placement locations.
  
- 1        2. The method of Claim 1, wherein identifying components to replicate comprises  
2        identifying a replication candidate with associated slack that exceeds a threshold value.
  
- 1        3. The method of Claim 2, further comprising determining a location for a duplicate of  
2        the replication candidate.
  
- 1        4. The method of Claim 3, further comprising determining slack gain associated with the  
2        duplicate of the replication candidate at the location.
  
- 1        5. The method of Claim 4, further comprising computing a gain value for the duplicate  
2        of the replication candidate.
  
- 1        6. The method of Claim 5, wherein computing the gain value comprising evaluating  
2        slack gain, the associated slack of the replication candidate, and illegalities associated with  
3        placement at the location.

1           7. The method of Claim 5, further comprising designating n components with a highest  
2       gain value as the components to replicate.

1           8. The method of Claim 1, further comprising performing incremental placement on  
2       duplicates of the components to replicate.

1           9. The method of Claim 8, further comprising:  
2       identifying additional components to replicate; and  
3       performing incremental placement on the duplicates of the additional components to  
4       replicate.

1           10. The method of Claim 8, further comprising routing the components and the  
2       duplicates of the components to replicate.

1           11. The method of Claim 1, further comprising removing a duplicate if a location of the  
2       duplicate is in a logic array block with its corresponding component to replicate.

1           12. The method of Claim 8, further comprising determining system slack for the system.

1           13. The method of Claim 12, further comprising restoring the system to its previous  
2       design if the system slack has decreased.

1           14. A method for designing a system on a target device utilizing field programmable gate  
2       arrays (FPGAs), comprising:  
3       determining placement locations for components on the target device;

4 identifying components to replicate in response to criticality determined from the  
5 placement locations; and  
6 performing incremental placement to resolve an illegality in placement of a duplicate of a  
7 component to replicate.

1 15. The method of Claim 14, wherein identifying components to replicate comprises  
2 identifying a replication candidate with associated slack that exceeds a threshold value.

1 16. The method of Claim 15, further comprising determining a location for a duplicate of  
2 the replication candidate.

1 17. The method of Claim 16, further comprising determining slack gain associated with  
2 the duplicate of the replication candidate at the location.

1 18. The method of Claim 17, further comprising computing a gain value for the duplicate  
2 of the replication candidate.

1 19. The method of Claim 18, wherein computing the gain value comprising evaluating  
2 slack gain, the associated slack of the replication candidate, and illegalities associated with  
3 placement at the location.

1 20. The method of Claim 18, further comprising designating n components with a highest  
2 gain value as the components to replicate.

1 21. The method of Claim 14, wherein performing incremental placement to resolve  
2 illegalities in placement of duplicates of the components to replicate comprises:

3 generating a proposed move for the duplicate;  
4 generating cost function values for a current placement with the proposed move; and  
5 accepting the proposed move if its associated cost function value is better than the cost  
6 function value of the current placement.

1 22. The method of Claim 21, wherein generating the proposed move comprises moving  
2 the duplicate to a logic-array block (LAB) that is a fanin of the duplicate.

1 23. The method of Claim 21, wherein generating the proposed move comprises moving  
2 the duplicate to a logic-array block (LAB) that is a fanout of the duplicate.

1 24. The method of Claim 21, wherein generating the proposed move comprises moving  
2 the duplicate to a logic-array block (LAB) that is a sibling of a LAB where the duplicate resides.

1 25. The method of Claim 21, wherein generating the proposed move comprises moving  
2 the duplicate to a logic-array block (LAB) that is adjacent to the duplicate.

1 26. A machine-readable medium having stored thereon sequences of instructions, the  
2 sequences of instructions including instructions which, when executed by a processor, causes the  
3 processor to perform:  
4 synthesizing a design for a system;  
5 mapping components in the design onto resources on a target device;  
6 determining placement locations for the components on the target device; and  
7 identifying components to replicate in response to criticality determined from the  
8 placement locations.

1           27. The machine-readable medium of Claim 26, wherein identifying components to  
2 replicate comprises identifying a replication candidate with associated slack that exceeds a  
3 threshold value.

1           28. The machine-readable medium of Claim 27, further comprising instructions which  
2 when executed further performs determining a location for a duplicate of the replication  
3 candidate.

1           29. The machine-readable medium of Claim 28, further comprising instructions which  
2 when executed further performs determining slack gain associated with the duplicate of the  
3 replication candidate at the location.

1           30. The machine-readable medium of Claim 29, further comprising instructions which  
2 when executed further performs computing a gain value for the duplicate of the replication  
3 candidate.

1           31. The machine-readable medium of Claim 30, wherein computing the gain value  
2 comprising evaluating slack gain, the associated slack of the replication candidate, and illegalities  
3 associated with placement at the location.

1           32. The machine-readable medium of Claim 30, further comprising instructions which  
2 when executed further performs designating n components with a highest gain value as the  
3 components to replicate.

1           33. The machine-readable medium of Claim 26, further comprising performing  
2 incremental placement on duplicates of the components to replicate.

1           34. The method of Claim 1, wherein identifying components to replicate comprises  
2   identifying a replication candidate with associated path delay that exceeds a threshold value.